FOSTER
REFRIGERATOR

Service Manual

SOLO PLUS

CEILING MOUNTED UNITS

2001 to 2009

ISO 14001 ISO 9001

SOLO PLUS UNITS

Introduction

It is important to note that all work should be carried out by a competent person.

Solo plus is a range of self contained refrigeration units for small and large coldrooms comprising hot gas defrost with crankcase protection, capillary control and hot gas vaporisation.
The systems are pre-charged with refrigerant and pre-wired ready for installation into a coldroom with only electrical connections to be made.
Under certain conditions a drain pipe may be required to drain any excess defrost water to an external source

Routine Maintenance
In order to keep the unit operating reliably and efficiently periodical cleaning of the condenser is necessary. (The frequency being determined by site conditions)
This operation is to be carried out with the unit turned OFF. We advise the use of an air jet blowing from inside to the outside. If an air jet is not available then use a soft long haired brush on the outside of the condenser taking care not to damage the fins.
Warning: Condenser fins have sharp edges so care must be taken to avoid injury

Model Table

Model	SP1HC SP2HC SP3HC SP4HC SP5HC	SP1HC SP2HC SP3HC SP4HC SP5HC	SP1HC SP2HC SP3HC SP4HC SP5HC	SP1LC SP2LC SP3LC

NOTE: Nomenclature **"C"** refers to Ceiling Model
As each model operates at different temperatures it will be necessary to set the required operating temperature.
See operating instruction on pages 5 to 6, 15 to 16, 22 to 23 and parameter list on pages 7, 17 and 24 to 25.

For Foster spare parts information and prices go to www.fosterrefigerator.co.uk.
Once you have accessed the home page select 'Spares' from the menu on the left hand side of the page.
The screen will change to the 'Welcome to Foster WebSpares' page.
Click on 'Browse Product' and from there and select the product range you require followed by the model.

Select the part you require from the list or use the mouse pointer to highlight the part from the drawing, click the left mouse button for the part number, description and price to be displayed on the right hand side of the screen.
For service manuals click on Service Documentation and select from the list.

Environmental Management Policy.

Product Support and Installation Contractors

Foster Refrigerator recognises that its activities, products and services can have an adverse impact upon the environment.
The organisation is committed to implementing systems and controls to manage, reduce and eliminate its adverse environmental impacts wherever possible, and has formulated an Environmental Policy outlining our core aims. A copy of the Environmental Policy is available to all contractors and suppliers upon request.

The organisation is committed to working with suppliers and contractors where their activities have the potential to impact upon the environment. To achieve the aims stated in the Environmental Policy we require that all suppliers and contractors operate in compliance with the law and are committed to best practice in environmental management.

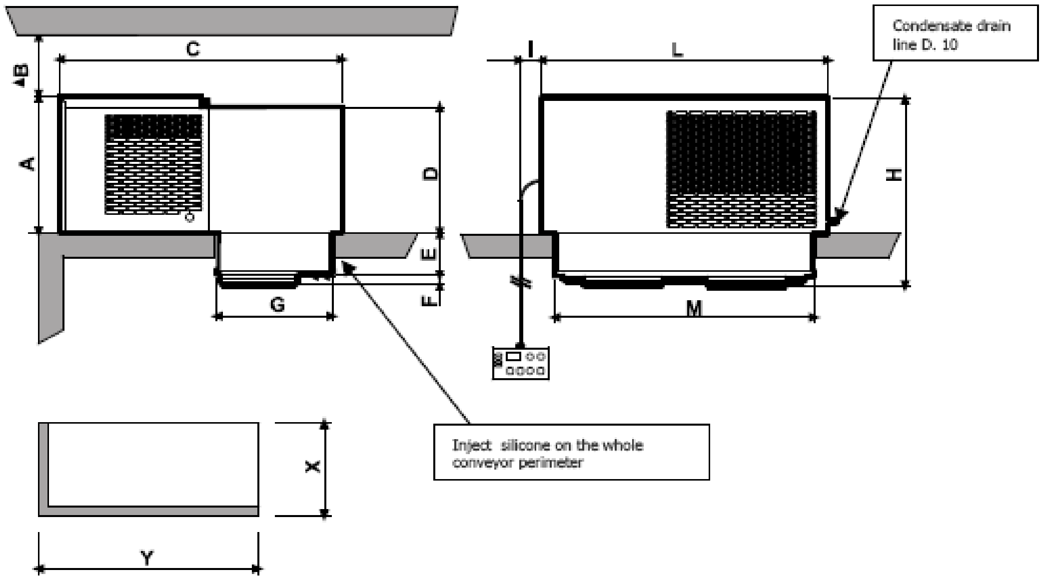
Product Support and Installation contractors are required to:

1. Ensure that wherever possible waste is removed from the client's site, where arrangements are in place all waste should be returned to Foster Refrigerator's premises. In certain circumstances waste may be disposed of on the client's site; if permission is given, if the client has arrangements in place for the type of waste.
2. If arranging for the disposal of your waste, handle, store and dispose of it in such a way as to prevent its escape into the environment, harm to human health, and to ensure the compliance with the environmental law. Guidance is available from the Environment Agency on how to comply with the waste management 'duty of care'.
3. The following waste must be stored separately from other wastes, as they are hazardous to the environment: refrigerants, polyurethane foam, oils.
4. When arranging for disposal of waste, ensure a waste transfer note or consignment note is completed as appropriate. Ensure that all waste is correctly described on the waste note and include the appropriate six-digit code from the European Waste Catalogue. Your waste contractor or Foster can provide further information if necessary.
5. Ensure that all waste is removed by a registered waste carrier, a carrier in possession of a waste management licence, or a carrier holding an appropriate exemption. Ensure the person receiving the waste at its ultimate destination is in receipt of a waste management licence or valid exemption.
6. Handle and store refrigerants in such a way as to prevent their emission to atmosphere, and ensure they are disposed of safely and in accordance with environmental law.
7. Make arrangements to ensure all staff who handle refrigerants do so at a level of competence consistent with the City Guilds 2078 Handling Refrigerants qualification or equivalent qualification.
8. Ensure all liquid substances are securely stored to prevent leaks and spill, and are **not** disposed of to storm drains, foul drain, surface water to soil.

DISPOSAL REQUIREMENTS

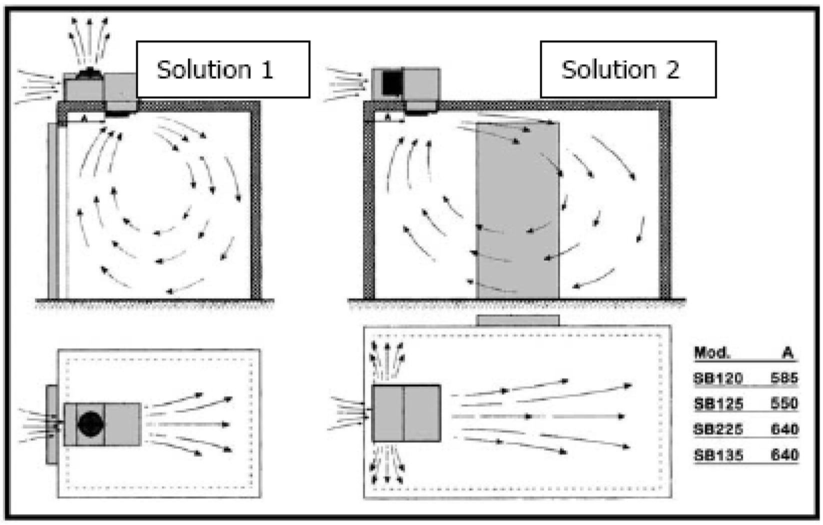
If not disposed of properly all refrigerators have components that can be harmful to the environment. All old refrigerators must be disposed of by appropriately registered and licensed waste contractors, and in accordance with national laws and regulations.

Dimensions.



	A	B	C	D	E	F	G	H	I	L	M	X	Y
SP1/SP2	357	250	719	340	122	28	332	506	60	620	545	337	550
SP3/SP4	390	250	809	360	122	28	332	540	60	820	745	337	750
SP5	427	250	929	410	122	98	452	645	60	820	745	456	750

Location & Installation



Ceiling Mount Solo Units Power Absorption Table

Model	Electrical Supply	Compressor	Unit Absorption			
			Max	Start	Run	
			Amp	Amp	Amp	KW
SP1HC	230/1/50	CAJ9480Z/F/CSR	7.90	25.00	4.30	0.70
SP2HC	230/1/50	CAJ9510Z/F/CSR	8.40	32.00	5.0	0.80
SP3HC	230/1/50	CAJ9513Z/FCSR	12.00	34.00	6.30	1.00
SP4HC	400/3/50	TAJ4517Z/T	5.90	22.00	4.30	1.50
SP5HC	400/3/50	MTZ28JE4	5.60	24.00	7.20	2.30
SP2LC	230/1/50	CAJ2464Z/F/CSR	11.30	42.00	5.50	0.90
SP3LC	400/3/50	TFH2480Z/T	5.80	27.00	4.20	1.50
SP4LC	400/3/50	TFH2511ZT	6.80	32.00	4.80	2.00

CEILING MOUNT SOLO PLUS TECHNICAL DATA

STORAGE TEMP +10°C

Foster Model No	Ref Gas	Qty Grms	Capillary size No x exDia X intDia x Len
SP 1HC	R404A	0.54	1 x 1,63 x 2,90 x L 2200
SP 2HC	R404A	0.60	1 x 1.83 x 3,25 x L 3100
SP 3HC	R404A	0.73	2 x 1,83 x 3,25 x L 3100
SP 4HC	R404A	0.70	2 x 1,98 x 3,50 x L 2900
SP 5HC	R404A	1.10	2 x 1,98 x3,50 x L 2000

STORAGE TEMP +1/4°C

Foster Model No	Ref Gas	Qty Grms	Capillary size No x exDia X intDia x Len
SP 1HC	R404A	0.54	1 x 1,6 3x 2,90 x L 2200
SP 2HC	R404A	0.60	1 x 1.83 x 3,25 x L 3100
SP 3HC	R404A	0.73	2 x 1,83 x 3,25 x L 3100
SP 4HC	R404A	0.70	2 x 1,98 x 3,50 x L 2900
SP 5HC	R404A	1.10	2 x 1,98 x3,50 x L 2000

STORAGE TEMP 0/-2°C

Foster Model No	Ref Gas	Qty Grms	Capillary size No x exDia X intDia x Len
SP 1HC	R404A	0.54	1 x 1,63 x 2,90 x L 2200
SP 2HC	R404A	0.60	1 x 1.83 x 3,25 x L 3100
SP 3HC	R404A	0.73	2 x 1,83 x 3,25 x L 3100
SP 4HC	R404A	0.70	2 x 1,98 x 3,50 x L 2900
SP 5HC	R404A	1.10	2 x 1,98 x3,50 x L 2000

STORAGE TEMP –18/-21°C

Foster Model No	Ref Gas	Qty Grms	Capillary size No x exDia X intDia x Len
SP 1LC	R404A	0.42	1 x 1,49 x 2,80 x L 1900
SP 2LC	R404A	0.84	1 x 1,98 x 3,50 x L 3000
SP 3LC	R404A	0.96	2 x 1,63 x 2,90 x L 2900

STORAGE TEMP +10°C

Foster Model No	Nom HP	HP Cut Out Press. Bar	HP Cut In Press. Bar	Suction Valve Press. Bar	Noise Level dBa	Heat Rejected Max Watts @ 32°C	Room Vent. m³/ h #	32°C Ambient		43°C Ambient		Air	Air Vol	Volts	Electrical Phase	Hz	Nominal		**Defrost** Type	Condensate Vaporisation	Net. Wt. Kg	Gross Wt. Kg
								Watts	Room Cap. m³	Watts	Room Cap. m³	Throw mts	m³/ h				Amps	Watts				
SP 1HC	0.625	-------	--------	-------	59	2300	750	1500	10	1400	7	3	550	230	1	50	4.4	700	Hot Gas	Auto	59	90
SP 2HC	0.75	-------	--------	-------	60	2675	750	1750	12	1600	10	3	550	230	1	50	5.2	800	Hot Gas	Auto	59	90
SP 3HC	1	-------	--------	-------	60	3750	1400	2600	20	2200	16	3.5	1100	230	1	50	6.9	1100	Hot Gas	Auto	74	114
SP 4HC	1.2	28	23	-------	60	4200	1400	2900	28	2700	22	3.5	1100	400	3	50	4.4	1500	Hot Gas	Auto	75	115
SP 5HC	2	28	23	-------	63	7200	1500	5200	56	4600	48	6	2300	400	3	50	5.1	2100	Hot Gas	Auto	93	139

STORAGE TEMP +1/4°C

Foster Model No	Nom HP	HP Cut Out Press. Bar	HP Cut In Press. Bar	Suction Valve Press. Bar	Noise Level dBa	Heat Rejected Max Watts @ 32°C	Room Vent. m³/ h #	32°C Ambient		43°C Ambient		Air	Air Vol	Volts	Electrical Phase	Hz	Nominal		**Defrost** Type	Condensate Vaporisation	Net. Wt. Kg	Gross Wt. Kg
								Watts	Room Cap. m³	Watts	Room Cap. m³	Throw mts	m³/ h				Amps	Watts				
SP 1HC	0.625	--------	--------	-------	59	1950	750	1150	7	1050	5	3	550	230	1	50	4.4	700	Hot Gas	Auto	59	90
SP 2HC	0.75	--------	--------	-------	60	2200	750	1350	9	1250	6	3	550	230	1	50	5.2	800	Hot Gas	Auto	59	90
SP 3HC	1	--------	--------	-------	60	2850	1400	1900	17	1600	10	3.5	1100	230	1	50	6.9	1100	Hot Gas	Auto	67	114
SP 4HC	1.2	28	23	-------	60	3350	1400	2300	20	2050	12	3.5	1100	400	3	50	4.4	1500	Hot Gas	Auto	75	115
SP 5HC	2	28	23	-------	63	5700	1500	4100	46	3600	28	4	2300	400	3	50	5.1	2100	Hot Gas	Auto	93	139

STORAGE TEMP 0/-2°C

Foster Model No	Nom HP	HP Cut Out Press. Bar	HP Cut In Press. Bar	Suction Valve Press. Bar	Noise Level dBa	Heat Rejected Max Watts @ 32°C	Room Vent. m³/ h #	32°C Ambient		43°C Ambient		Air	Air Vol	Volts	Electrical Phase	Hz	Nominal		**Defrost** Type	Condensate Vaporisation	Net. Wt. Kg	Gross Wt. Kg
								Watts	Room Cap. m³	Watts	Room Cap. m³	Throw mts	Air Vol				Amps	Watts				
SP 101HW	0.625	---------	--------	-------	59	1750	750	1050	6	925	4	3	550	230	1	50	4.4	700	Hot Gas	Auto	59	90
SP 2HC	0.75	---------	--------	-------	60	2000	750	1200	7	1100	5	3	550	230	1	50	5.2	800	Hot Gas	Auto	59	90
SP 3HC	1	---------	--------	-------	60	2650	1400	1700	12	1450	9	3.5	1100	230	1	50	6.9	1100	Hot Gas	Auto	74	114
SP 4HC	1.2	28	23	-------	60	3150	1400	2000	15	1700	12	3.5	1100	400	3	50	4.4	1500	Hot Gas	Auto	75	115
SP 5HC	2	28	23	-------	63	5100	1500	3600	36	3200	26	6	2300	400	3	50	5.1	2100	Hot Gas	Auto	93	139

STORAGE TEMP –18/-21°C

Foster Model No	Nom HP	HP Cut Out Press. Bar	HP Cut In Press. Bar	Suction Valve Press. Bar	Noise Level dBa	Heat Rejected Max Watts @ 32°C	Room Vent. m³/ h #	32°C Ambient		43°C Ambient		Air	Air Vol	Volts	Electrical Phase	Hz	Nominal		**Defrost** Type	Condensate Vaporisation	Net. Wt. Kg	Gross Wt. Kg
								Watts	Room Cap. m³	Watts	Room Cap. m³	Throw mts	Air Vol				Amps	Watts				
SP 2LC	1.7	--------	--------	2.5	61	2050	750	1200	6	1050	3	3	550	230	1	50	5.9	900	Hot Gas	Auto	68	99
SP 3LC	2	28	23	2.5	61	2850	1400	1650	11	1400	7	3.5	1100	400	3	50	4.2	1400	Hot Gas	Auto	87	118
SP 4LC	3	28	23	2.5	63	5000	1400	2400	18	2200	13.5	6	2300	400	3	50	4.6	1800	Hot Gas	Auto	102	142

STORAGE TEMP -25°C

Foster Model No	Nom HP	HP Cut Out Press. Bar	HP Cut In Press. Bar	Suction Valve Press. Bar	Noise Level dBa	Heat Rejected Max Watts @ 32°C	Room Vent. m³/ h #	32°C Ambient		43°C Ambient		Air	Air Vol	Volts	Electrical Phase	Hz	Nominal		**Defrost** Type	Condensate Vaporisation	Net. Wt. Kg	Gross Wt. Kg
								Watts	Room Cap. m³	Watts	Room Cap. m³	Throw mts	Air Vol				Amps	Watts				
SP 2LC	1.7	--------	--------	2.5	61	1650	750	950	3	825	2	3	550	230	1	50	5.9	900	Hot Gas	Auto	68	99
SP 3LC	2	28	23	2.5	61	3300	1400	1200	6	1000	4	3.5	1100	400	3	50	4.2	1400	Hot Gas	Auto	87	118
SP 4LC	3	28	23	2.5	63	3600	1400	2000	10	1650	6	6	2300	400	3	50	4.6	1800	Hot Gas	Auto	102	142

NOTE: Noise levels taken in a room with a concrete floor, no sound attenuation and ceiling height of 7 metres with the unit base 1.5 metres from floor level, installed in a coldroom and the Sound Metre at 3 metres distance.

NOTE: The condenser fan pressure thermostat fitted on Low Ambient units should be set at 17bar with a 1.5bar differential; this applies to high and low temperature models.

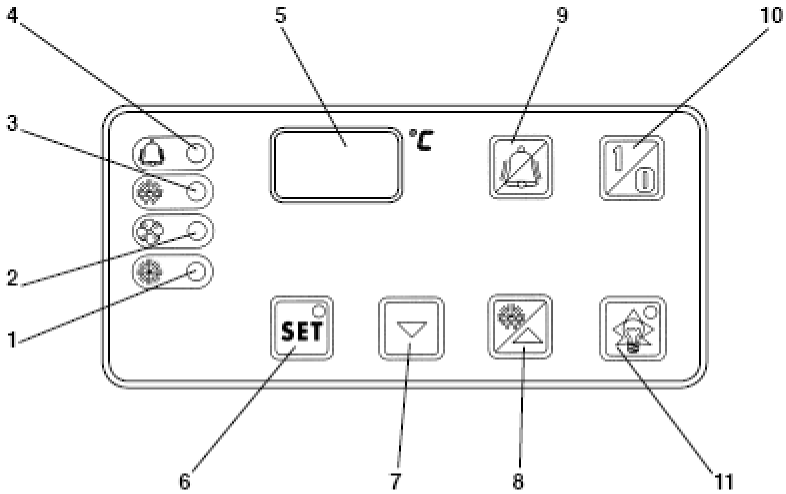
Access to the Unit Compartment and Evaporator Housing

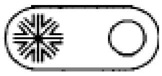
Unit Housing
Remove the 4 fixing screws from the front panel and "pull upwards" to release it from the 2 spring clips located at the top.

Evaporator Assembly
Remove the 4 fixing screws from the fan plate and lower allowing access to the evaporator fan motor and the evaporator assembly.

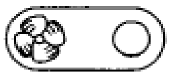
Controller Operation and Parameter Access for Ceiling Mounted Solo Units with the Serial Number Ending in 'H'.

Description of Electronic Panel

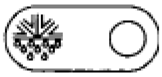




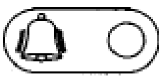
1) Compressor LED (Green)
Lit: The compressor is running. Unit is in cooling mode.
Flashing: The compressor is in a delayed start mode.
Off: The compressor is OFF. The required room temperature has been reached



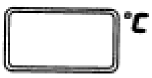
2) Evaporator Fan LED (Green)
Lit: Evaporator fan is running
Flashing: The evaporator fan is in delayed start mode
OFF: The evaporator fan is OFF. Unit in defrost modes



3) Defrost LED (Yellow)
Lit: Automatic or manual defrost in progress



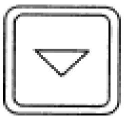
4) Alarm LED (Red)
Lit: Alarm mode: malfunction of a sensor, or intervention of pressure-stat or room temperature outside preset limits.
OFF: Unit working correctly



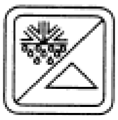
5) Display
When the machine is not in operation, the label "OFF" and the room temperature are intermittently displayed one after the other on the digital display. When the machine is in operation, during the normal working cycle, the display indicates the room temperature. Parameters labels will be displayed during programming.
A "Fault Code" will be displayed during an alarm mode



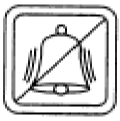
6) "SET" KEY
Permits entry of room temperature requirements



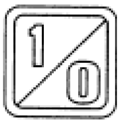
7) "DOWN" KEY
Key to reduce data values



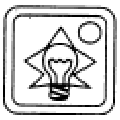
8) "MANUAL DEFROST/UP" KEY
Key to increase data values
Press for 8 seconds to initiate a manual defrost



9) KEY "T.A.A."
Press the key mutes the audible alarm.
This alarm is not fitted as standard to the unit but can be added by the client.
To connect the alarm use the volt free terminals 1 & 2 on the internal electronic panel.
Terminal 2 should have a live feed connected to it



10) "ON/OFF"KEY
Main switch



11) "LAMP" KEY
Press to turn the room light ON/OFF. A red LED illuminates if the light is ON

Room Temperature Settings
With the unit in the normal operating mode, the only active keys are the  and the  key. The later is always operative except when in programming mode.

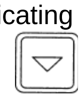
Room Temperature Programming:

Press the key  to turn on the unit. It is therefore necessary to set the room to the required temperature bearing in mind the limits of the range that the unit is able to operate within.

Temperature Range	Minimum Temperature	Maximum Temperature	Recommended Temperature
"H" Range	**-5ºC**	**+10 ºC**	
General Purpose			+3 ºC
Chilled			+1 ºC
Fresh Meat			+2 ºC
"L" Range	**-25ºC**	**-15ºC**	-21ºC

To display the temperature set point press  and the yellow LED will illuminate and the current set temperature will be displayed.

Press  again and the yellow LED will illuminate for 1 second followed by the value indicated on the display flashing for a few seconds, indicating the set temperature.

To change the setting use the  or  buttons and once the required setting is displayed press  to confirm.

Parameter Modification

Press and hold  plus  more than 5 seconds and **'00'** will be displayed.

Press  until **'22'** is displayed.

Press  to confirm and the first parameter will be displayed.

Press  to display the value or use the  or  key to scroll through the parameters.

To change the value use the  or  key and once changed use the  key to confirm the change.
When all of the modifications have been completed press  to store the changes and exit the parameter mode.

Parameters Ceiling Mounted Solo Units with the Serial Number Ending in 'H'.

Label	Description	Unit Of Measure	Range		Medium Temp Hot Gas Defrost	Low Temp Hot Gas Defrost
			Min	Max		
/C	Allows an offset to the value of the air probe	ºC/ºF	-20	20	0	0
/2	Digital Filter (DO NOT ADJUST)	-	1	15	4	4
/3	Input Limitation (DO NOT ADJUST)	-	1	15	8	8
/4	Virtual Probe (Average value measured by the air & evaporator probes)	-	0	100	0	0
/5	Allows the Choice of operating temperature between Celsius & Fahrenheit	flag	0	1	0	0
/6	Allows the decimal point in temperature readout (0=NO, 1=YES)	flag	0	1	0	0
rd	Set point	ºC/ºF	0,1	19,9	2	2
r1	Minimum allowed set point	ºC/ºF	-40	r2	-5	-25
r2	Maximum allowed set point	ºC/ºF	r1	199	10	-15
r3	Disables the high temperature alarm during defrost	flag	0	1	0	0
r4	Allows the variation of the set point with the curtain closed	ºC/ºF	0	20	0	0
r5	Enables or disables the display of the air probe value rH and rL measured in tr time	flag	0	1	0	0
rt	Defines in hours the temperature monitoring time interval during which rH and rL are updated. rH=rL= temperature.	hours	0	199	-	-
rH	Shows the maximum temperature measured by the air probe during the time interval rt	ºC/ºF	-50	90	-	-
rL	Shows the minimum temperature measured by the air probe during the time interval rt	ºC/ºF	-50	90	-	-
c0	Delay time between compressor starts	minutes	0	-15	0	0
c1	Minimum time between two compressor starts	minutes	0	15	3	3
c2	Minimum time OFF between compressor starts	minutes	0	15	2	2
c3	Minimum time the compressor must be ON after activation	minutes	0	15	0	0
c4	Security Relay (DO NOT ADJUST)	minutes	0	100	8	8
d0	Defrost type (0=elec, 1= hot gas, 2 = elec with time out, 3 =hot gas with time out)	Flag	0	1	1	1
d1	Defrost interval	hours	0	199	4	4
dt	Defrost end temperature	ºC/ºF	-40	199	15	15
dp	Defrost end time	minutes	1	199	20	20
d4	Allows a defrost activation when the device is turned on	flag	0	1	0	0
d5	Defines the time internal between reset and the beginning of a defrost	minutes	0	199	0	0
d6	Display lock during defrost (if locked dF is displayed)	flag	0	1	0	0
dd	Dripping time	minutes	0	15	2	2
d8	Alarm delay after defrost and after door open	hours	0	15	1	1
d9	Ignores the protection times for the compressor for a defrost to start.	flag	0	1	0	0
d/	Displays the value of the evaporator probe if fitted	ºC/ºF	-	-	-	-
dC	Allows for the time to be changed from hours to minutes for defrost. (0 =dl in hours, dp in minutes. 1 = dl in minutes, dp in seconds)	flag	0	1	0	0
A0	Alarm and Fan differential	ºC/ºF	0,1	20	2	2
AL	Low temperature alarm	ºC/ºF	0	199	5	5
AH	High temperature alarm	ºC/ºF	0	199	5	5
Ad	Temperature Alarm Delay	minutes	0	199	199	199
A4	Digital input	-	0	7	5	5
A5	2nd Digital input configuration	-	0	7	0	0
A6	Compressor failure due to external alarm (A6=0 compressor OFF)	minutes	0	100	0	0
A7	Delay time activation for A4 or A5 digital input (0 = OFF)	minutes	0	199	0	0
F0	Fan management (0 = always on except for F2, F3, Fd)	flag	0	1	0	0
F1	Fans ON when the evaporator temp is less than Set Point + F1	ºC/ºF	0	20	20	20
F2	Fans OFF when compressor stops (0 = ON , OFF = OFF)	flag	0	1	0	0
F3	Fans ON/OFF during defrost (0 = ON. 1 = OFF)	flag	0	1	1	1
Fd	Dripping time	minutes	0	15	1	1
H0	Serial Address	-	0	15	0	0
H1	Light/Alarm relay	flag	0	1	0	0
P0	Maximum number of pressure trips in time as P1	flag	0	15	10	10
P1	Pressure Stat timer (maximum time for pressure trips as P0)	Min	0	199	60	60

Controller Reset for Ceiling Mounted Solo Units with the Serial Number Ending in 'H'.

Error in data collection is indicated by the controller displaying 'EA', 'EB' or 'EE'.

To restore the controller to the correct operation it is necessary to reset the controller default parameters using the following procedure:

Disconnect the unit from the mains supply.

With the power disconnected press and hold the  and switch the power back ON and the letter '**-C-**'will appear on the display.
After a few seconds the controller will be in reset mode, release  and proceed to set the parameters to there correct settings as all of the values would have been set to the default values.

If after completing the reset '**EE**' persists press and hold  until the error disappears.

Air and Defrost Probe Resistance Values

Temperature	K ohms	Temperature	K ohms	Temperature	K ohms
+50 ºC	4161	+10 ºC	17,960	-20 ºC	67,740
+30 ºC	8015	0 ºC	27,280	-30 ºC	111,300
+20 ºC	12,090	-10 ºC	42,450	-50 ºC	329,200

Alarms and Warnings for Ceiling Mounted Solo Units with the Serial Number Ending in 'H'.

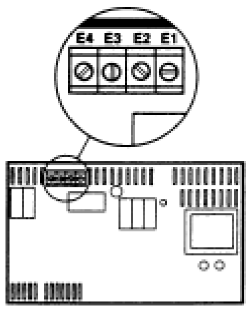
Code	Description
HI	High Temperature Alarm
LO	Low Temperature Alarm
E0	Air Probe Failure
E1	Evaporator Probe Failure
HH	High Pressure Alarm
PP	High Pressure Tripped more than 10 time in an hour.

Ceiling Mounted Solo Units with the Serial Number Ending in 'H' Controller Emergency Repair.

In case of fault or malfunction of the PCB, an '**EMERGENCY SYSTEM'** can be used as a short term measure to keep the unit running until a replacement panel can be fitted.
The **'EMERGENCY SYSTEM'** consists of a terminal board sited on the PCB, fitted as shown on fig1.

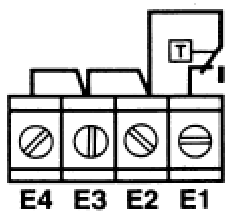
Proceed as follows to fit the Emergency System.

Fig 1

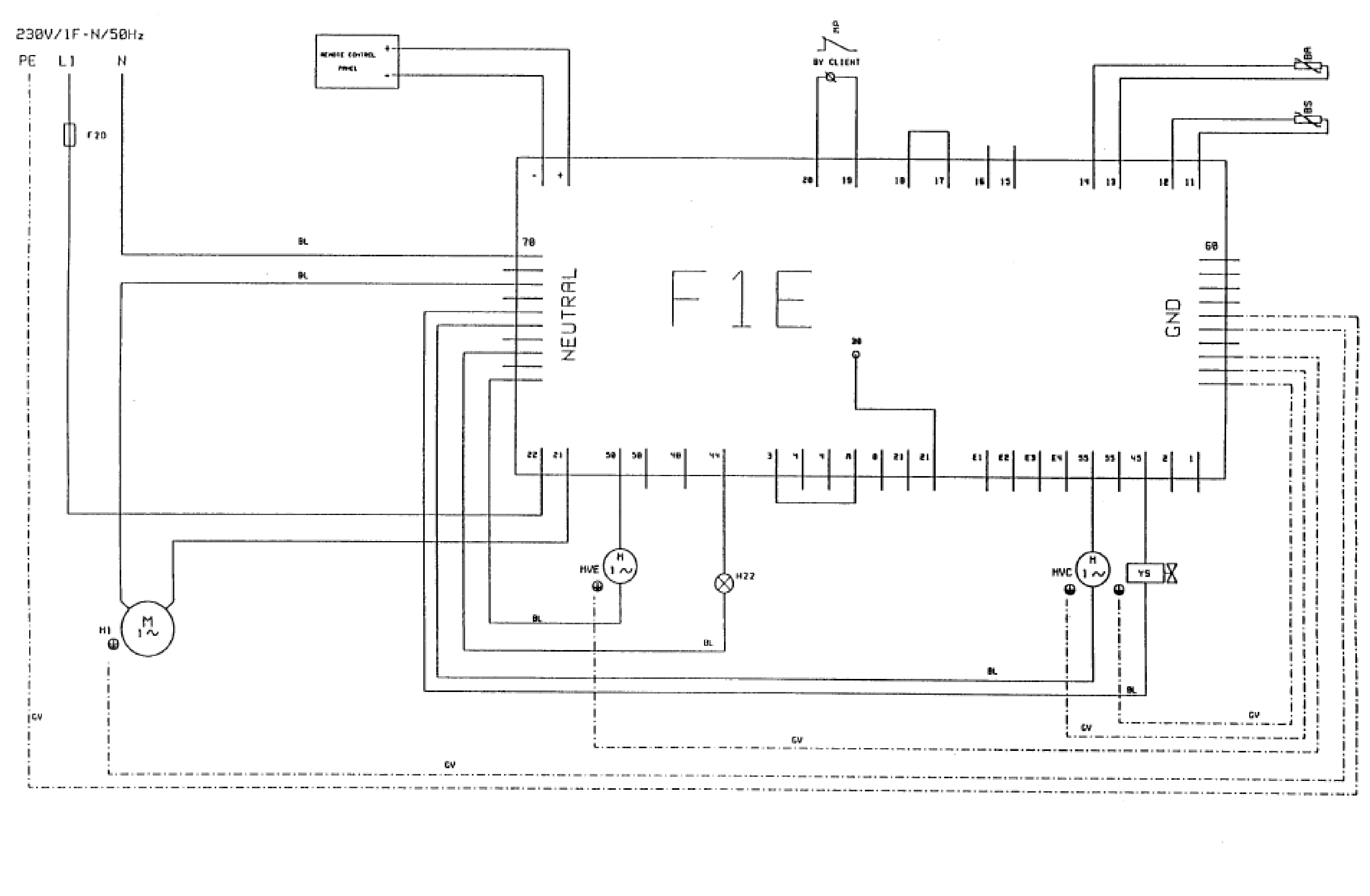


1. Switch the PCB off by pressing 
 Important Note: The PCB should remain in this condition whilst the emergency system is in place.
2. Disconnect the power supply to the unit
3. Connect a thermostat (6 inductive amps) to the terminals **E1** and **E2**, see fig 2.
4. Place a bridge between terminals **E2** and **E3** as well as terminals **E3** and **E4**, see fig 2.
5. Secure the bulb of the thermostat into the room.
6. Adjust the thermostat to the required temperature and turn the power ON to the unit.
7. When the set temperature is reached the compressor, evaporator and condenser fans will stop.
8. With this system in operation the defrost cycle is not functioning so it is important to limit the amount of door openings to a minimum.
9. When installing the replacement PCB it is important to remove all of the link wires from terminals **E2**, **E3**, **E4** and the thermostat from **E2** and **E1** before switching the unit ON. See fig 2.

Fig 2



Wiring Diagrams for Ceiling Mounted Solo Units with the Serial Number Ending in 'H'

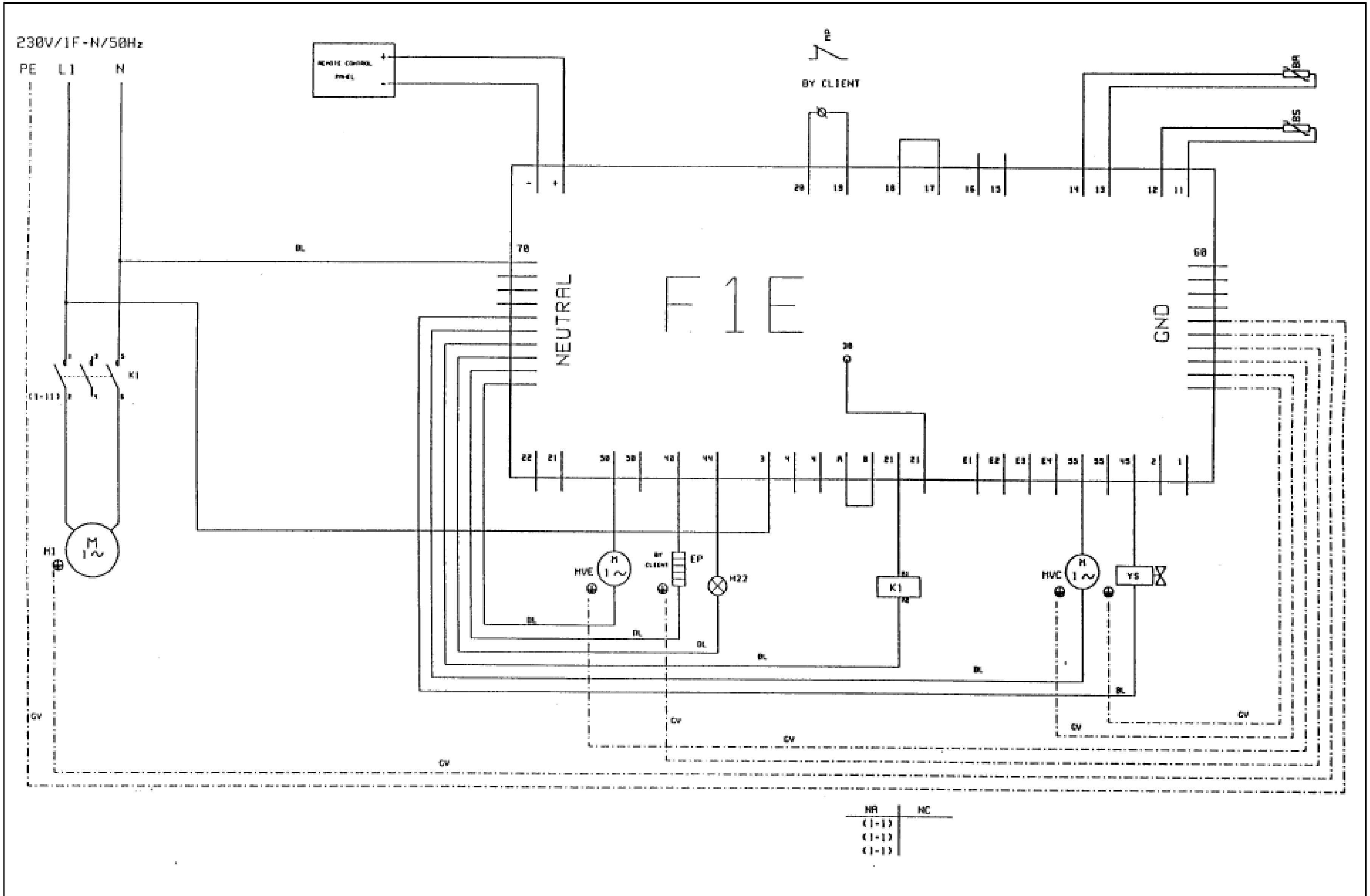


MODEL
SP 1HC
SP 2HC

HVC	Condenser Fan Motor	H22	Internal Light
HVE	Evaporator Fan Motor	MP	Door Switch (if fitted)
M1	Compressor	BS	Defrost Probe
YS	Hot Gas Solenoid Valve	BA	Air Probe

Rev No.		
Date:	Approved	

Drawing No.		Sheet No.
81800L		1 of 1
Drawn By	Approved	Date
Sonchi	Martinelli	04-12-1997

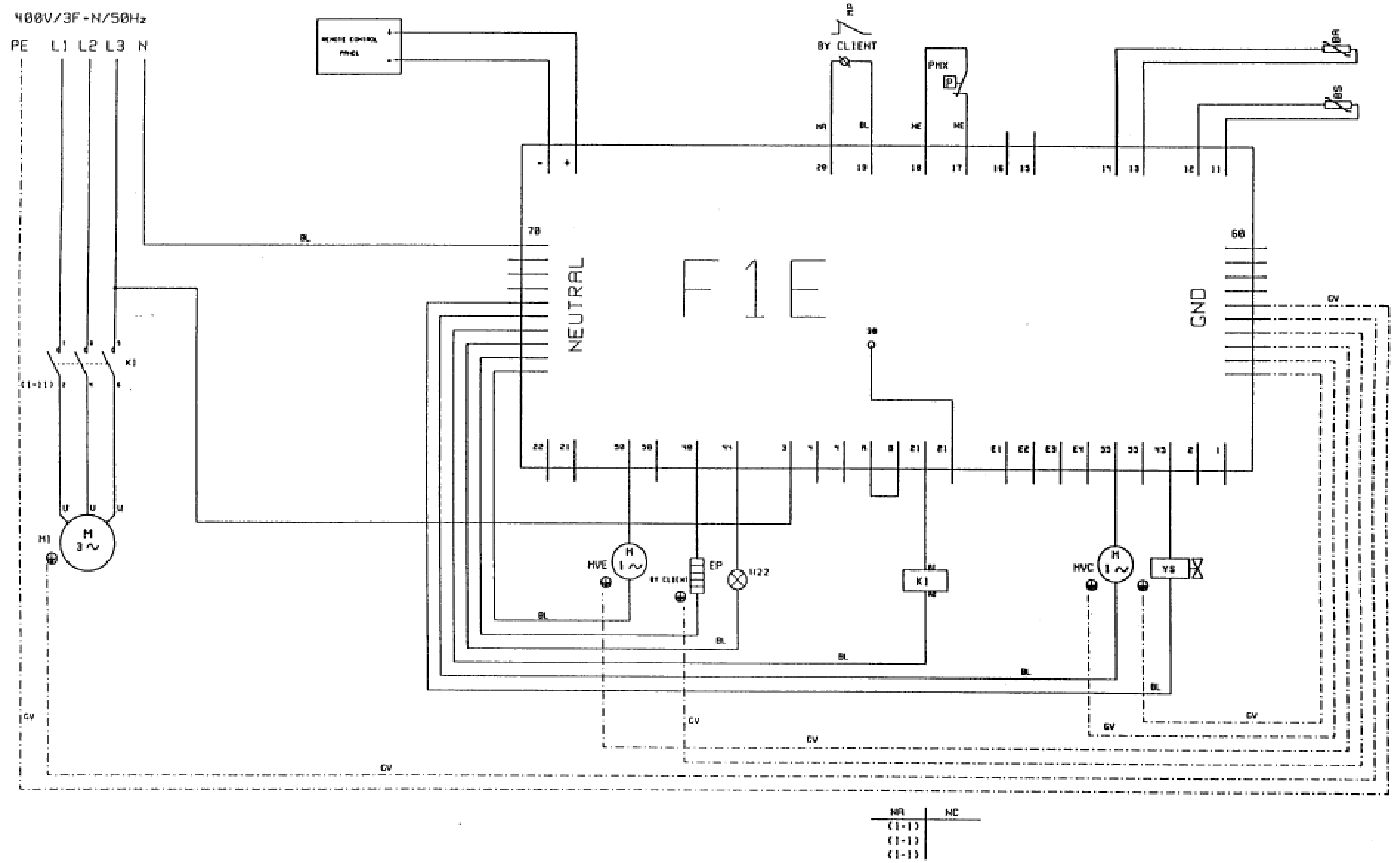


MODEL
SP 2LC
SP 3HC

HVC	Condenser Fan Motor	K1	Compressor Contactor	BS	Defrost Probe
HVE	Evaporator Fan Motor	H22	Internal Light	BA	Air Probe
M1	Compressor	EP	Door Frame Heater		
YS	Hot Gas Solenoid Valve	MP	Door Switch (if fitted)		

Rev No.			
Date:	Approved		

Drawing No. 81801L		Sheet No. 1 of 1
Drawn By Sonchi	Approved Martinelli	Date 81801L



MODEL
SP 3LC
SP 4LC
SP 4HC
SP 5HC

HVC	Condenser Fan Motor	K1	Compressor Contactor	PHX	High Pressure Switch
HVE	Evaporator Fan Motor	H22	Internal Light	BS	Defrost Probe
M1	Compressor	EP	Door Frame Heater (If fitted)	BA	Air Probe
YS	Hot Gas Solenoid Valve	MP	Door Switch (If fitted)		

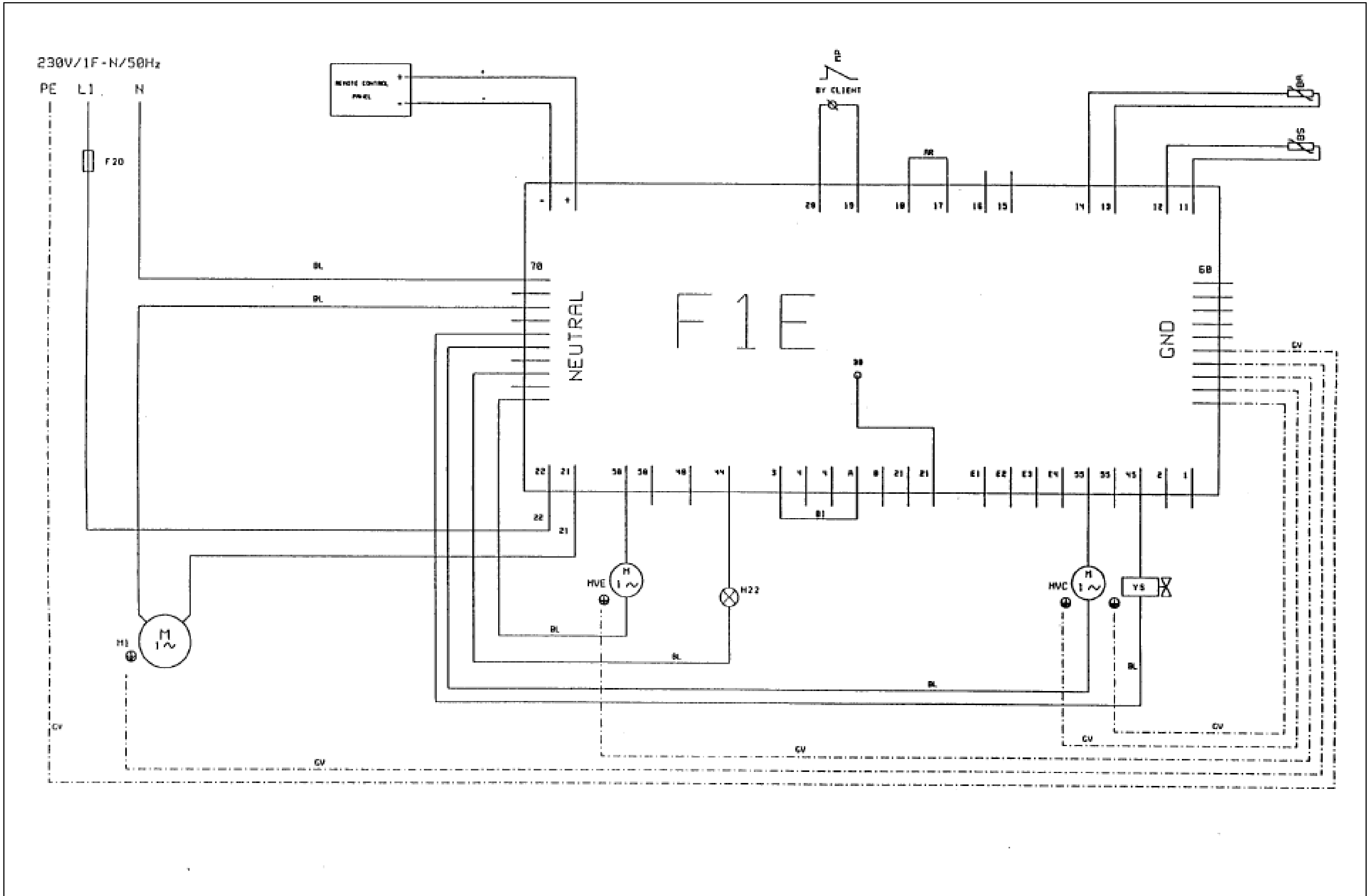
Rev No.

Date: Approved

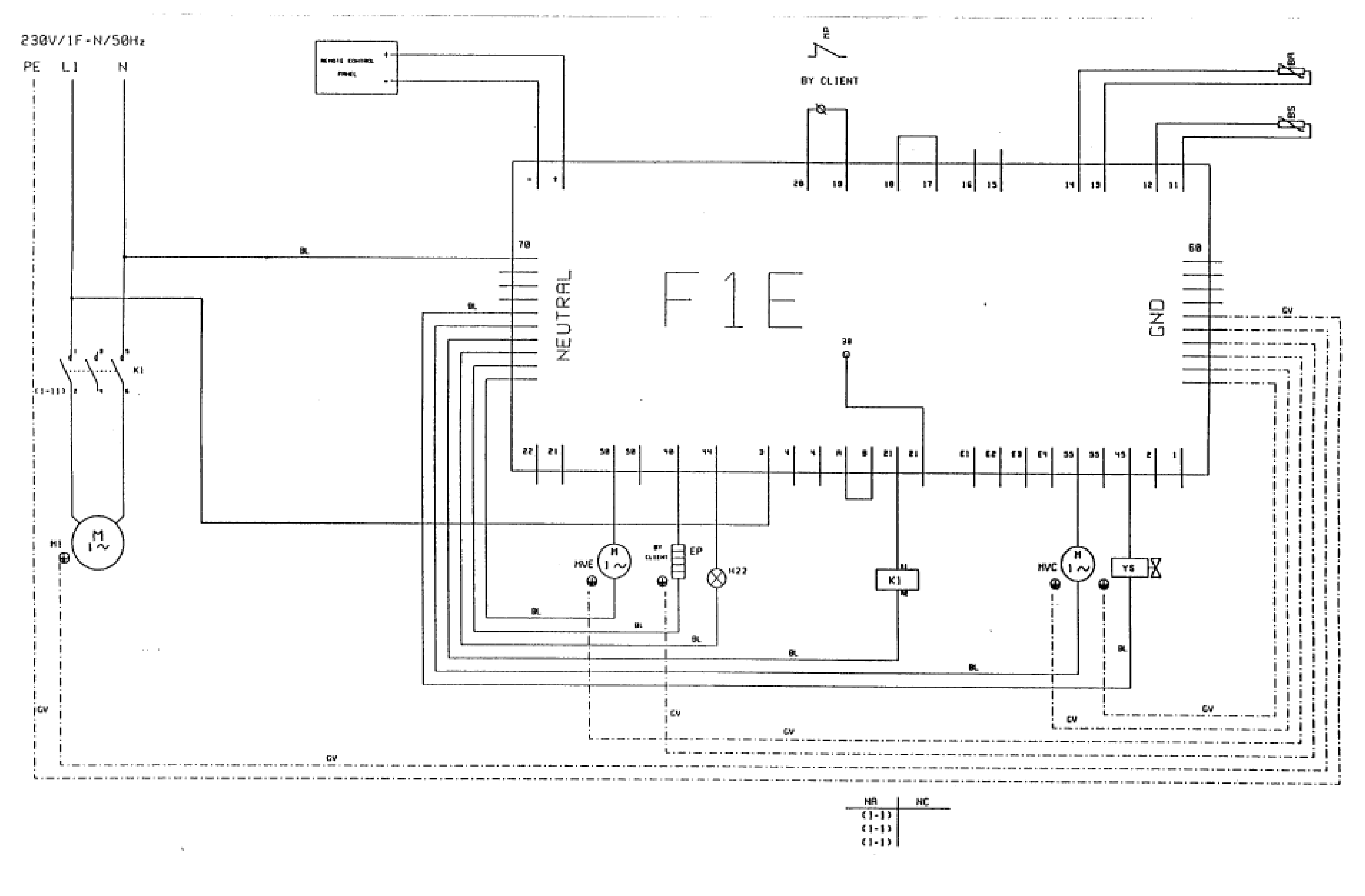
Drawing No. 81802L

Sheet No. 1 of 1

Drawn By	Approved	Date
Sonchi	Martinelli	04-12-1997



MODEL				
SP 1HW SP 2HW	HVC Condenser Fan Motor HVE Evaporator Fan Motor M1 Compressor YS Hot Gas Solenoid Valve	H22 Internal Light MP Door Switch (if fitted) BS Defrost Probe BA Air Probe	Rev No. Date: Approved	Drawing No. 81800M Sheet No. 1 of 1 Drawn By Sonchi Approved Martinelli Date 03-12-1997



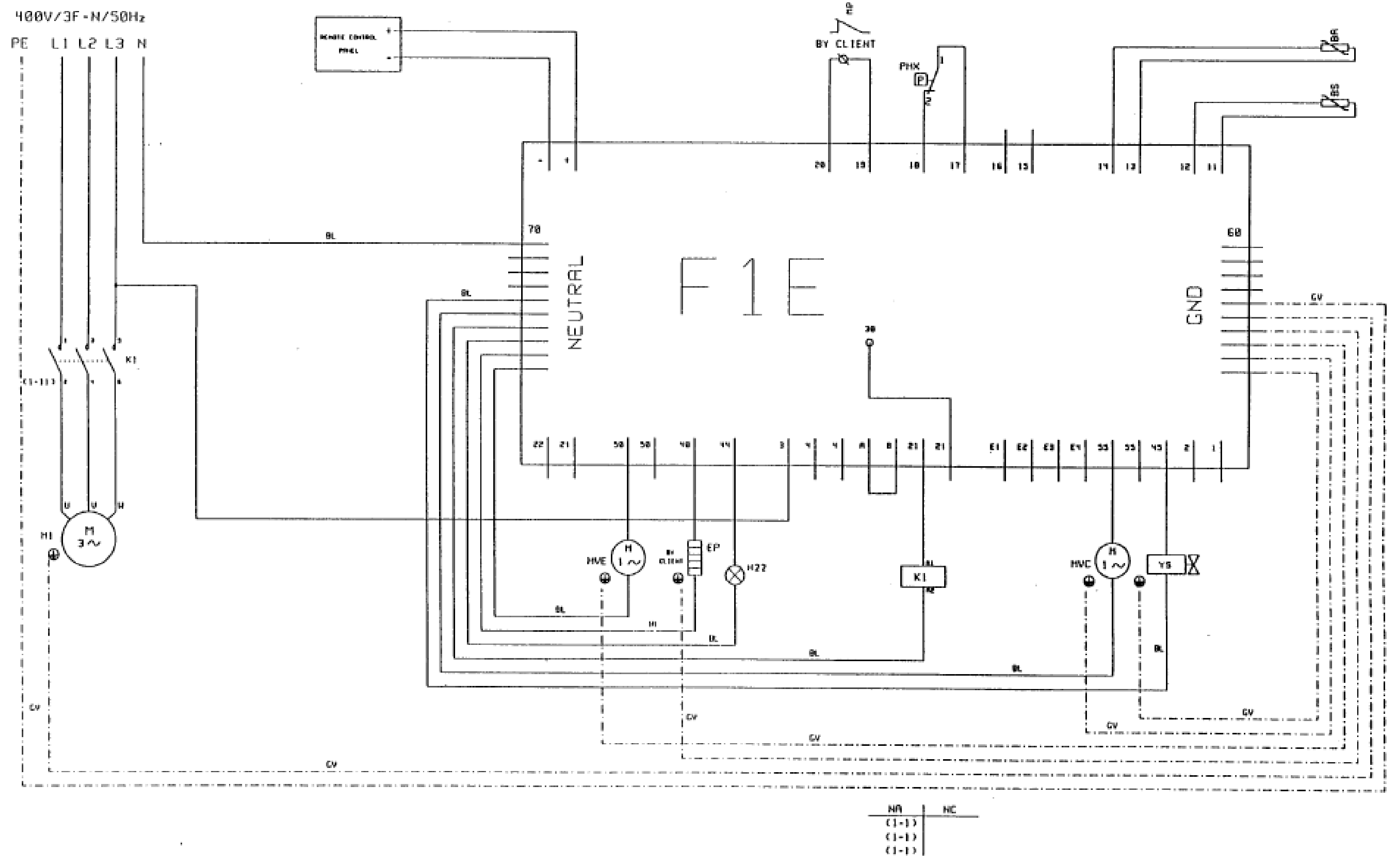
MODEL
SP 1LW
SP 2LW
SP 3HW

HVC	Condenser Fan Motor	K1	Compressor Contactor
HVE	Evaporator Fan Motor	H22	Internal Light
M1	Compressor	EP	Door Frame Heater
YS	Hot Gas Solenoid Valve	MP	Door Switch (If fitted)
BS	Defrost Probe		
BA	Air Probe		

Rev No.		Date:	Approved

Drawing No.	Sheet No.
81801M	1 of 1

Drawn By	Approved	Date
Sonchi	Martinelli	04-12-1997



MODEL
SP 3LW - SP 4LW - SP 5LW
SP 4 HW - SP 5HW

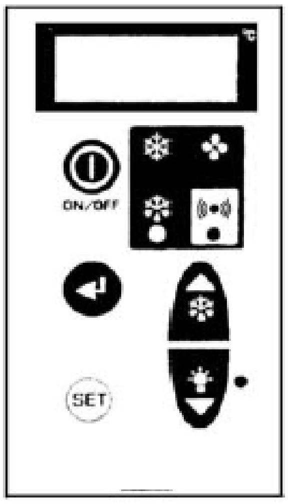
HVC	Condenser Fan Motor	K1	Compressor Contactor	BS	Defrost Probe
HVE	Evaporator Fan Motor	H22	Internal Light	BA	Air Probe
M1	Compressor	EP	Door Frame Heater	PHX	High Pressure Switch
YS	Hot Gas Solenoid Valve	MP	Door Switch (If fitted)		

Rev No.		
Date:	Approved	

Drawing No.		Sheet No.
81802M		1 of 1
Drawn By	Approved	Date
Sonchi	Martinelli	04-12-1997

Controller Operation for Ceiling Mounted Solo Units with the Serial Number Ending in 'I'

Description of electronic panel





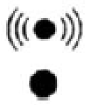
1. Control LED (Green):
LIT: Compressor running, Unit is refrigerating
FLASHING: Compressor is in start delay mode (waiting for signal to start)
OFF: Compressor is OFF. Room is down to temperature.



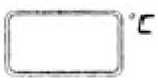
2. Control LED (Green):
ON: evaporator fan is running.
Flashing: evaporator fan is in start mode.
OFF: evaporator is off. Defrost in operation



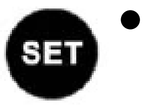
3. Control LED (Yellow):
LIT: Unit in defrost mode (auto or manual)
Flashing: Manual defrost mode in operation.



4. Alarm LED (Red):
LIT: Alarm is active – see separate ALARMS section.
OFF: Unit is functioning normally



5. Display: When connected to the mains the display will read OFF indicating the condition of the unit. By pressing the ON/OFF key for 5 seconds the unit will turn ON and display the room temperature. During programming mode the various parameters will be displayed and during alarm mode an alarm code will be displayed.



6. SET/ESC key: Pressed for 3 seconds, the led is lit and setting of required room temperature is enabled. During programming it is used to pass from a sub menu to an upper one.



7. DOWN/ ROOM LIGHT Key: During programming mode or setting of room temperature it serves to reduce the displayed value. At other times it serves to control the room light



8. DEFROST/ UP Key: By pressing for more than 4 seconds it activates a manual defrost. During programming mode or setting of room temperature it serves to increase the displayed value



9. ON/OFF Key: To turn the unit ON or OFF press and hold for more than 3 seconds.



10. ENTER Key: Permits access to the programming menu and passage to the sub menu. Access to this programming mode should be by qualified persons only.

Note:

Prior to switching on the unit the following checks should be made.
Connect the mains supply.
All electrical connections are terminated correctly.
All fixing screws are fully tightened.
Having made the pre start checks switch on the unit:
The display will illuminate and OFF appears on the display.

Room temperature settings.

Set the required room temperature.

Turn the unit **ON** using the **ON/OFF** ON/OFF key.

Programming room temperature.

To set the required room temperatures press the **SET** SET key for more than 3 seconds.
The Green LED will light and the previous set temperature will be displayed.

To increase the set value press the **UP** key until the desired temperature is achieved.

To lower the set value press the **DOWN** key until the desired temperature is achieved.

On completion press the **SET** SET key or wait 5 seconds for the changes to be saved.

Controller Parameters Access Instruction for Models with Serial Number Ending in 'I'

Press and hold the set key for more than 5 seconds and '**00'** will be displayed.

Press the **UP** key until '22' appears on the display

Press the set SET key to confirm

The first parameter to be changed will be displayed.

Press the **UP** or **DOWN** key to scroll through the parameter list.

Select the parameter to be changed and press the **SET** SET key to display the value.

Use the **UP** or **DOWN** key to change the value to the new setting.

Press the **SET** SET key to confirm the new value.

Continue through the parameters making the necessary changes and on completion press **ENTER** key to memorise the changes made.

If the **ENTER** key is not pressed after making the changes the modifications will not be saved.

Controller Part Numbers for Models with Serial Number Ending in 'I'

Front Display PCB for all models 15344014
Controller PCB for High Temp Models 15344016
Controller PCB for Low Temp Models 15344017

Controller Parameters for Models with Serial Number Ending in 'I'

Label	Description	Unit of measure	Min value	Max value	High temp models	Low temp models
IC	Setting	°C	-20	20	0	0
I2	Reading Stability	-	1	15	4	4
I3	Reading Speed	-	1	15	6	6
I4	Virtual Probe	-	0	100	0	0
I5	°C / °F (0 =°C. 1 = °F)	flag	0	1	0	0
I6	Decimal Point (0 = Yes. 1 = No)	flag	0	1	0	0
rd	Differential	°C/°F	0.1	19.9	2	2
r1	Minimum Allowable Set Point	°C/°F	-40	r2	-5	-25
r2	Maximum Allowable Set Point	°C/°F	r1	199	10	-15
r4	Automation Variation Set Point in Night Time Operation	°C/°F	0	20	0	0
r5	Activation Checks Least Temperature Min and Max	flag	0	1	0	0
rt	Actual Time Range Min and Max Temperature Detection	hour	0	199	-	-
rH	Max Temperature Detected in rt Time Range	°C/°F	-50	90	-	-
rL	Min Temperature Detected in rt Time Range	°C/°F	-50	90	-	-
c0	Compressor Delay Insertion After Control Reset	minutes	0	15	0	0
c1	Minimum Time Between Two Insertions	minutes	0	15	3	3
c2	Minimum Off Routine	minutes	0	15	2	2
c3	Minimum On Routine	minutes	0	15	0	0
c4	Safety Relay (0 = Off. 100 = On) See Duty Setting	minutes	0	100	8	8
d0	Defrost Type (0 = Electric. 1 = Hot Gas)	flag	0	1	1	1
d1	Time Interval Between Defrosts	hours	0	199	4	4
dt	Defrost End Temperature	°C/°F	-40	199	15	15
dP	Maximum Defrost Duration	minutes	1	199	20	20
d3	Activation Ed Alarm	flag	0	1	0	0
d4	Defrost After Control Switch (0 = No. 1 = Yes)	flag	0	1	0	0
d5	Defrost Delay After Control Switch On or From Malfunction Input	minutes	0	199	0	0
d6	Block of Display During Defrost (0 = No. 1 = Yes)	flag	0	1	0	0
dd	Dripping time	minutes	0	15	2	2
d8	Alarm Delay After Defrost/ or Door Open alarm if door Switch Fitted	hours	0	15	1	1
d9	Priority of Defrost Over Anticogging (0 = No. 1 = Yes)	flag	0	1	0	0
dI	Defrost Probe Reading	°C/°F	-	-	-	-
dC	Time Selection (0 = Hours/Minutes. 1 = Minutes/ Seconds)	flag	0	1	0	0
A0	Alarms and Fans Delta	°C/°F	0.1	20	2	2
AL	Low Temperature Alarm (with respect to the set point)	°C/°F	0	199	3	3
AH	High Temperature Alarm (with respect to the set point)	°C/°F	0	199	3	3
Ad	Alarm Temperature Delay	minutes	0	199	199	199
A4	Configuration Digital Input Nº 1 (door Micro Switch)	-	0	7	1	1
A5	Configuration Digital Input Nº 2 (Pre-Heating	-	7	5	5	5
A6	Compressor Lock To External Alarm (0 = Off. 100 = On)	minutes	0	100	0	0
A7	Delay Time For A4 or A5 Input	minutes	0	199	0	0
F0	Fan Control (0 = Always On Except F2, F3 and Fd)	flag	0	1	0	0
F1	Fans Switch Off Temperature (relating to the room Temperature)	°C/°F	0	20	20	20
F2	Fans Off When Compressor is Off (0 = No. 1 = Yes)	Flag	0	1	0	0
F3	Fans Off During Defrost (0 = No. 1 = Yes)	flag	0	1	1	1
Fd	Fans Stop After Dripping	minutes	0	15	1	1
H0	Serial Address	-	0	15	0	0
P0	Maximum Number of Pressure Switches	flag	0	15	10	10
P1	Time period for Pressure Switches	minutes	0	199	60	60
S2	Condenser Probe (0 = No. 1 = Yes)	flag	0	1	0	0
HAL	Condenser Probe Set Point	C	-50	90	55	55
AFd	Differential	C	012	12	2	2
TAO	Time Alarm Delay	minutes	0	250	0	0
SC	Display Condenser Probe	C	-	-	-	-

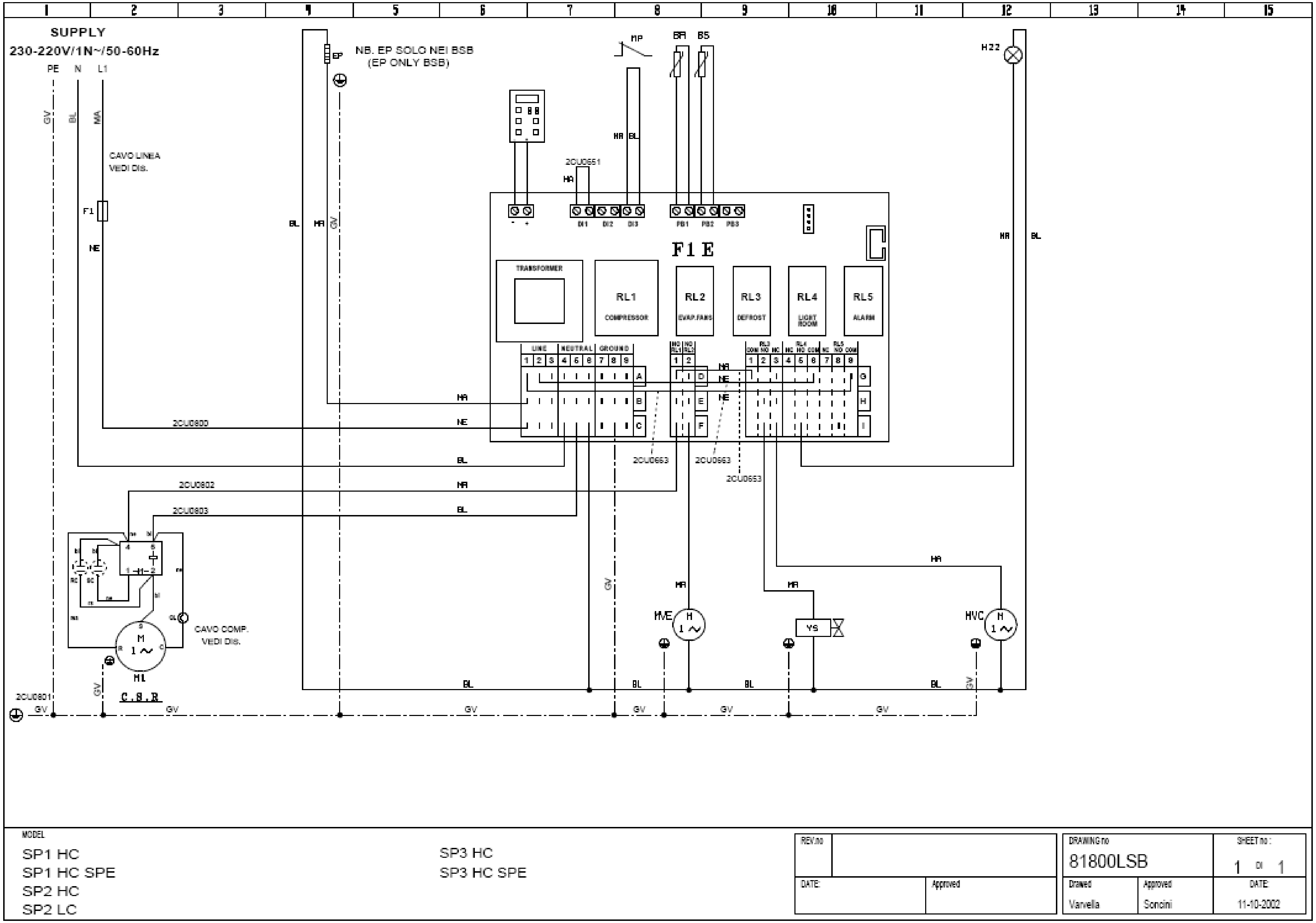
Alarms and Warnings for Ceiling Mounted Solo Units with the Serial Number Ending in 'I'.

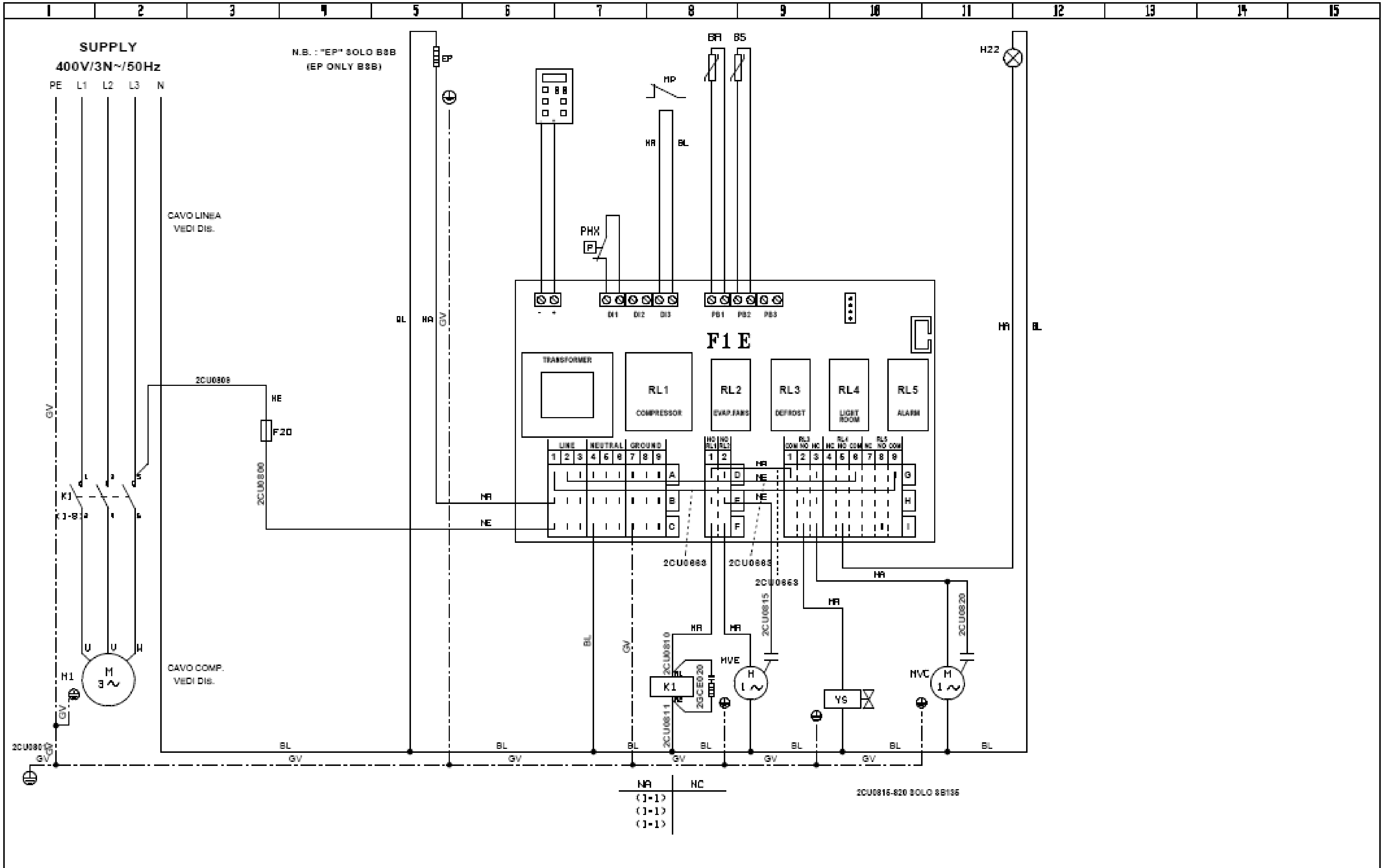
Code	Description	Code	Description
E0	Air Probe Fault	**AM**	Supply monitor
E1	Defrost Probe Fault	**AMD**	External Alarm From Digital Input
E2	Condenser Probe Fault (Not Fitted)	**LO**	Low Temperature Alarm
HH	High Pressure Trip	**Ed**	Defrost End Time Out
PP	High Pressure Trips 10 Times in 1 hour	**dF**	Unit In Defrost Mode

Wiring Diagram Code Identifications

BA	Room Sensor		**FTE**	Emergency 'Stat
BC	Condenser Alarm Sensor		**HI**	Alarm
BS	Defrost Sensor		**K1**	Contactor
BVR	Speed Regulator		**K11**	Defrost Contactor
BVRS	Speed Regulator Sensor		**M1**	Compressor Motor Nr.1
E	Defrost Heater		**MPC**	Door Microswitch (Room)
E1	Resistenza Carter Compressore		**MVC**	Condenser Fan Motor
M1	Compressor Crankcase Heater		**MVE**	Evaporator Fan Motor
EP	Door Heater Circuit		**P1MX**	Cond. Fan Starting Pressure Switch
ER1	Control Board Heater		**PMI**	L/P Switch
ER2	Voltage Regulator Heater		**PMX**	H/P Switch
ES	Condensate Drain Heater		**Q1**	Main Switch
F13	Voltage Regulator Fuse		**Q3**	Cond. Fan Speed Regulator "Off" Switch
F1	Compressor Fuse		**T**	Transformer
F1E	Electronic Control Cab		**X**	Terminal Board-Connector
F20	Auxiliary Fuse		**YG**	Refrigerant Solenoid
FL	Room Light Fuse		**YS**	Hot Gas Solenoid
FM	Voltage Regulator			

Wiring Diagrams for Ceiling Mounted Solo Units with the Serial Number Ending in 'I'





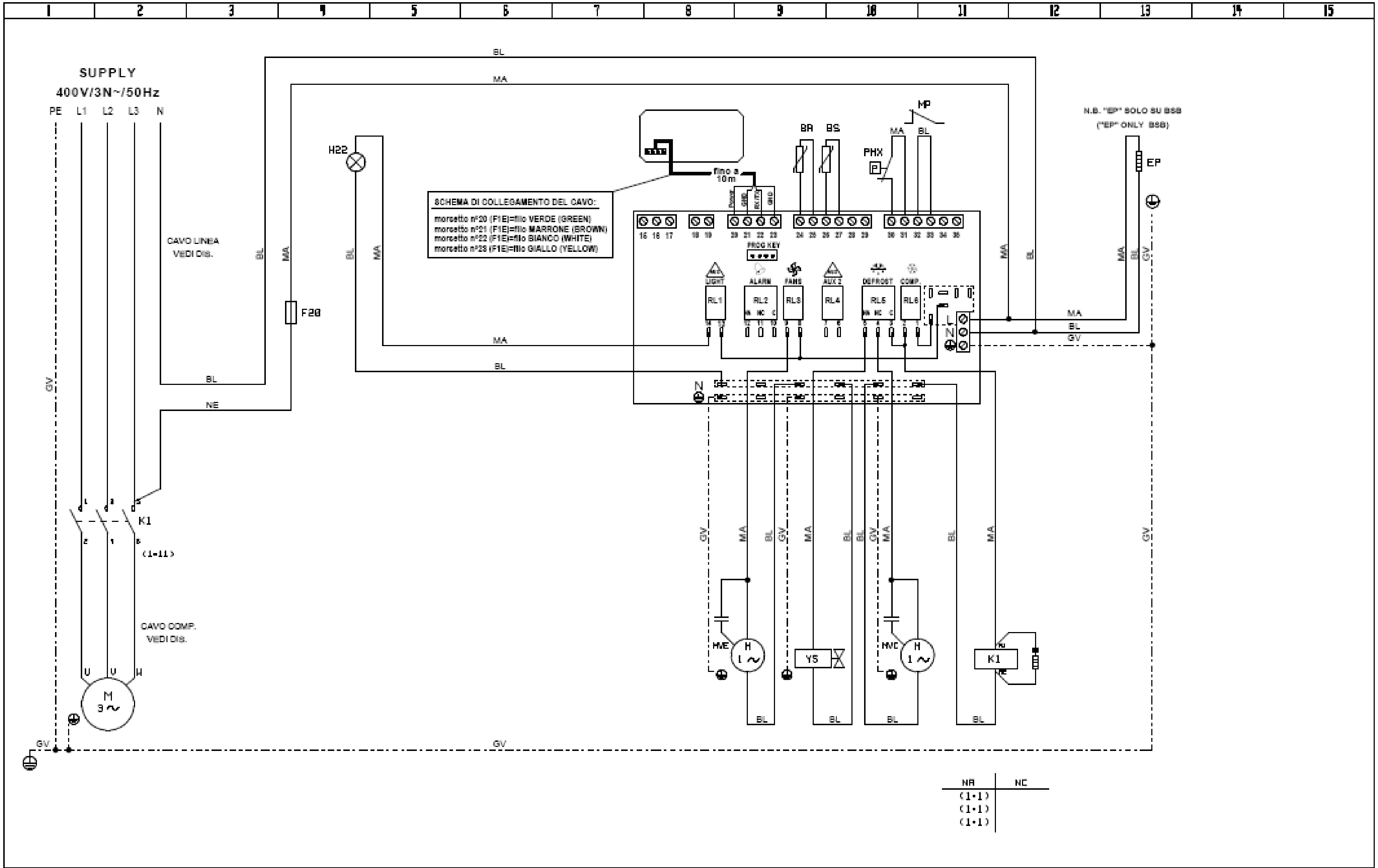
MODEL

SP3 LC
SP4 LC
SP4 HC
SP5 HC

SP5 HC SPE
SP4 LC SPE1

REV.no			
01	Tolto ponte su ID2		
DATE:		Approved	
21-01-2003		SONCINI	

DRAWING no		SHEET no :
81802LSB		1 DI 1
Drawed	Approved	DATE:
Varvella	Soncini	11-10-2002

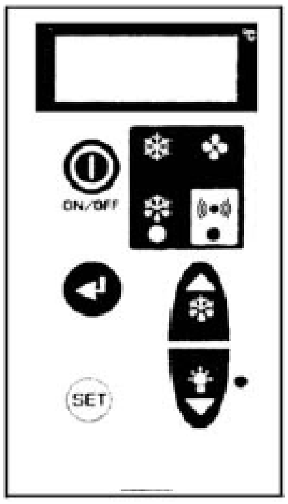


MODEL
SP 4HC PS
SP 5HC PS
SP 3LC PS
SP 4LC PS

REV.no		DRAWING no		SHEET no :
		81803LSB		1 DI 1
DATE:	Approved	Drawed	Approved	DATE:
		PEDRAZZOLI	SONCINI	24-05-2004

Controller Operation for Ceiling Mounted Solo Units with the Serial Number Ending in 'J'

Description of electronic panel





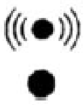
2. Control LED (Green):
LIT: Compressor running, Unit is refrigerating
FLASHING: Compressor is in start delay mode (waiting for signal to start)
OFF: Compressor is OFF. Room is down to temperature.



2. Control LED (Green):
ON: evaporator fan is running.
Flashing: evaporator fan is in start mode.
OFF: evaporator is off. Defrost in operation



3. Control LED (Yellow):
LIT: Unit in defrost mode (auto or manual)
Flashing: Manual defrost mode in operation.



4. Alarm LED (Red):
LIT: Alarm is active – see separate ALARMS section.
OFF: Unit is functioning normally



5. Display: When connected to the mains the display will read OFF indicating the condition of the unit. By pressing the ON/OFF key for 5 seconds the unit will turn ON and display the room temperature. During programming mode the various parameters will be displayed and during alarm mode an alarm code will be displayed.



6. SET/ESC key: Pressed for 3 seconds, the led is lit and setting of required room temperature is enabled. During programming it is used to pass from a sub menu to an upper one.



7. DOWN/ ROOM LIGHT Key: During programming mode or setting of room temperature it serves to reduce the displayed value. At other times it serves to control the room light



8. DEFROST/ UP Key: By pressing for more than 4 seconds it activates a manual defrost. During programming mode or setting of room temperature it serves to increase the displayed value



9. ON/OFF Key: To turn the unit ON or OFF press and hold for more than 3 seconds.



10. ENTER Key: Permits access to the programming menu and passage to the sub menu. Access to this programming mode should be by qualified persons only.

Note:

Prior to switching on the unit the following checks should be made.
Connect the mains supply.
All electrical connections are terminated correctly.
All fixing screws are fully tightened.
Having made the pre start checks switch on the unit:
The display will illuminate and OFF appears on the display.

Room temperature settings.

Set the required room temperature.

Turn the unit **ON** using the **ON/OFF** key.

Programming room temperature.

To set the required room temperatures press the **SET** key for more than 3 seconds.
The Green LED will light and the previous set temperature will be displayed.

To increase the set value press the **UP** key until the desired temperature is achieved.

To lower the set value press the **DOWN** key until the desired temperature is achieved.

On completion press the **SET** key or wait 5 seconds for the changes to be saved.

Controller Parameters Access Instruction for Models with Serial Number Ending in 'J'

Press and hold the **ENTER** key for 5 seconds and the first parameter will be displayed.

The first parameter to be changed will be displayed.

Press the **UP** or **DOWN** key to scroll through the parameter list.

Select the parameter to be changed and press the **SET** key to display the value.

Use the **UP** or **DOWN** key to change the value to the new setting.

Press the **SET** key to confirm the new value and move to the next parameter.

Once all of the changes have been made leave for 15 seconds for the changes to be stored after which the controller will return to display the room temperature.

Controller Part Numbers for Models with Serial Number Ending in 'J'

Front Display PCB for all models 15344143
Controller PCB for High Temp Models 15344144
Controller PCB for Low Temp Models 15344145

Controller Parameters for Models with Serial Number Ending in 'J'

Label	Description	Unit of measure	Min value	Max value	High temp models	Low temp models
HY	Differential	°C	0.1	-25.5	2	2
LS	Minimum Set Point	°C	-50	Set	-5	-25
US	Maximum Set Point	°C	Set	-150	10	-15
OdS	Outputs Activation Delay at Start Up	minutes	0	255	0	0
AC	Anti-short Cycle Delay	minutes	0	20	2	2
Con	Compressor ON Time With Air Probe Failure	minutes	0	255	15	15
CoF	Compressor OFF Time With Air Probe Failure	minutes	0	255	30	30
CF	Temperature Unit Of Measure	flag	°C (0)	°F(1)	°C	°C
rES	Resolution (integer/decimal point)	flag	In(0)	dE(1)	dE	dE
Lod	Local Display	P1=0. P2=1. P3=2			P1	P1
tdF	Defrost Type (rE = Electric. In = Hotgas)	flag	rE	In	in	In
EdF	Defrost Mode (in=0. sd=1)	flag	in	Sd	in	In
SdF	Set point for Smart Defrost	°C	-30	30	0	0
dtE	Defrost Termination Temperature (1º Evaporator)	°C	-50	150	15	15
IdF	Interval Between Defrost Cycles	hour	1	120	4	4
MdF	Defrost Time Termination	minutes	0	255	20	20
dFd	Display During Defrost	Rt=0. it=1. Set=2. dEF=3. dEG =4			it	It
dAd	Display Delay After Defrost	minutes	0	255	15	15
dSd	Defrost Delay After Calling	minutes	0	99	0	0
Fdt	Draining time	minutes	0	60	2	2
dPo	Defrost After Start Up (N=0. Y=1)	flag	n	Y	n	n
FnC	Fans Operating Mode (C-n=0. C-y=1. O-n=2. O-y=3)	C-n. C-y. O-n. O-y.			C-n	C-n
Fnd	Fan Delay After Defrost	minutes	0	255	3	3
FSt	Fans Stop Temperature	°C	-50	-150	40	40
ALC	Temperature Alarm Configuration	rE(0). Ab(1)			rE	rE
ALU	Maximum Temperature Alarm (re 0.0 to 50.0. Ab -50 to -150)	flag	re	Ab	5	5
ALL	Minimum Temperature Alarm (re 0.0 to 50.0. Ab -50 to -150)	flag	re	Ab	5	5
AFH	Temperature Alarm and Fan Differential	°C	0.1	25.5	2	2
ALd	Temperature Alarm Delay	minute	0	255	0	0
dAo	Delay of Temperature Alarm at Start Up	hours	0	23	3	4
EdA	Alarm Delay at End of Defrost	minutes	0	255	60	60
Dot	Delay of Temperature Alarm After Door Closing	minutes	0	255	60	60
doA	Door Open Alarm Delay	minutes	0	254	60	60
tbA	Alarm Relay Silencing	flag	N (0)	Y(1)	Y	Y
nPS	Pressure Switch Activation Number	flag	1	15	10	10
nPn	Pressure Switch Interval	minutes	1	60	60	60
AU2	High Temperature Alarm Probe	°C	-50	-150	55	55
AH2	Delay of Temperature Alarm at Start UP for Probe 3	°C	0.1	25.5	2	2
Ad2	Temperature Alarm Delay for Probe 3	minutes	0	255	0	0
dA2	Delay of Temperature Alarm at Start UP for Probe 3	hours	0	23	0	0
AC2	Lock of Regulation with P3 Probe Temperature Alarm	flag	N(0)	Y(1)	N	N
Ot	Thermostat Probe Calibration	°C	-12	12	0.0	0.0
oE	Evaporator Probe Calibration	°C	-12	12	0	0
O3	Auxiliary Probe Calibration	°C	-12	12	0	0
P2P	Evaporator Probe Fitted (0 = N. 1 = Y)	flag	n	Y	Y	Y
P3P	Auxiliary Probe Fitted (0 = N. 1 = Y)	flag	n	Y	n	n
HES	Temperature Increase During Energy Saving Cycle	°C	-30	30	0	0
odC	Open Door Control (0 = no. 1 = Fan. CPr = 2. F-C = 3)	no. Fan. CPr. F-C			F-C	F-C
rrd	Regulation Restart With Door Open Alarm (0 = N. 1 = Y)	flag	n	Y	Y	Y
i1P	Digital Input 1 Polarity (0 =CL. 1 = OP)	flag	CL	OP	OP	OP
iI2P	Digital Input 2 Polarity (0 =CL. 1 = OP)	flag	CL	OP	cL	cL
iI3P	Digital Input 3 Polarity (0 =CL. 1 = OP)	flag	CL	OP	OP	OP
i2F	Digital Input 2 Function (EAL = 0. bAL = 1.dFr = 2.dor = 3. ES=4. OnF=5)	EAL. bAL. dFr. dor. ES. OnF.			bAL	bAL
i3F	Digital Input 2 Function (EAL = 0. bAL = 1.dFr = 2.dor = 3. ES=4. OnF=5)	EAL. bAL. dFr. dor. ES. OnF.			dor	Dor
did	Digital input Alarm Delay	minutes	0	255	0	0
AoP		flag	cL	op	cL	cL
Pbc	Probe Type	flag	Ptc	ntc	ntc	Ntc
Adr	Serail Address	flag	1	247	1	1
dP1	Probe 1 Display	-	-	-	-	-
dP2	Probe 2 Display	-	-	-	-	-

dP3	Probe 3 Display	-	-	-	-	-
rEL	Software Release	-	-	-	-	-
Ptb	Map Code	-	-	-	-	-
Pr2	Access Parameter List	-	-	-	-	-

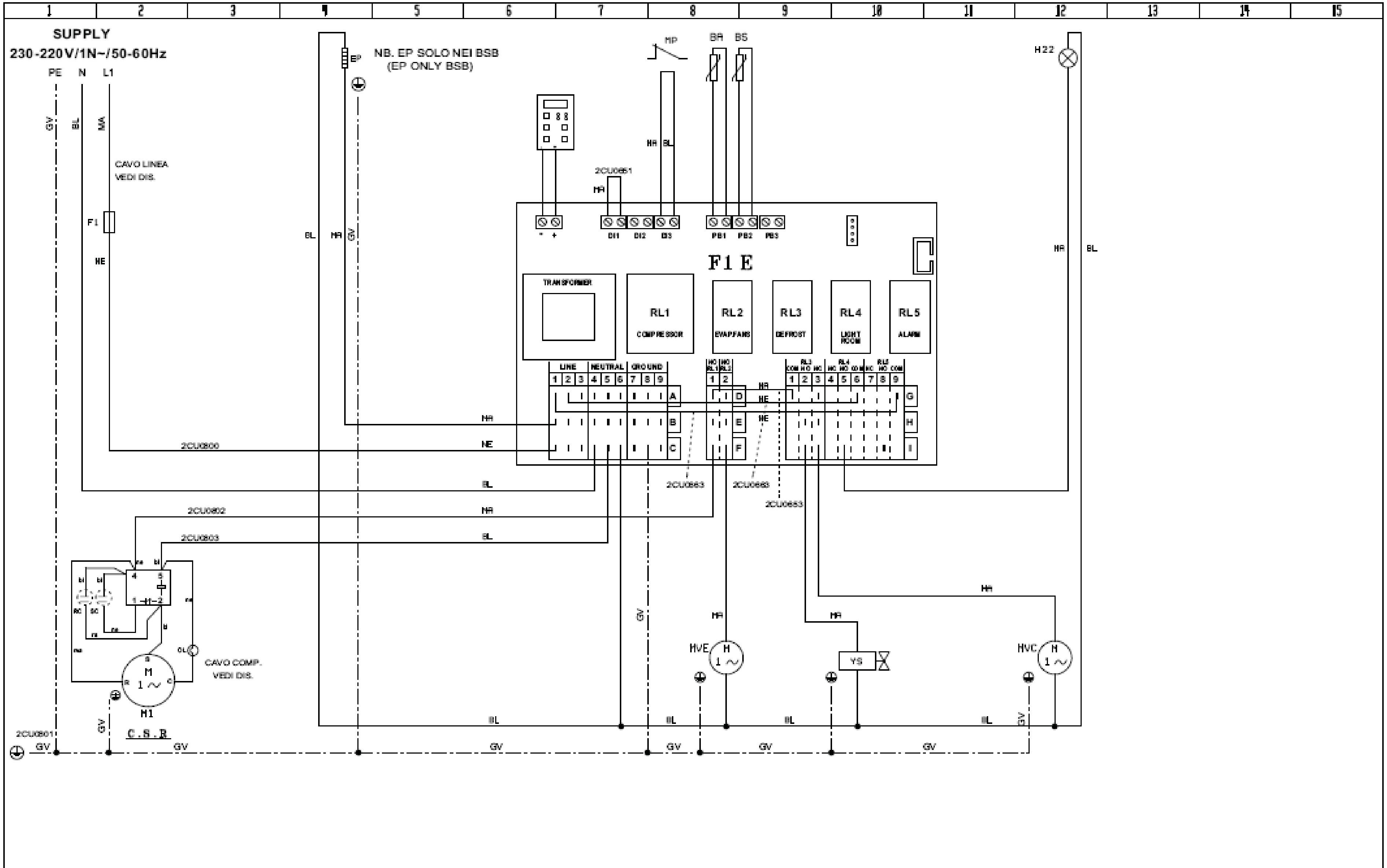
Alarm Descriptions with Serial Number End Letter ending in ‘J’.

CODE	DESCRIPTION
PI	Ambient Probe
P2	End Defrost Probe
P3	Third Probe (Not used)
POF	Display Locked Unable to turn unit ON or OFF To Unlock press the UP and Down buttons and PON will be displayed
HA	High Temperature
LA	Low Temperature
EE	Software - Memory Failure
dA	Door Open
EAL	External Alarm from Digital Input
BAL	Supply Monitor
PnE	High Pressure
PAL	High Pressure (After ten trips)

Wiring Diagram Code Identifications

BA	Room Sensor		**H22**	Coldroom Light
BC	Condenser Alarm Sensor		**HA**	Alarm
BS	Defrost Sensor		**HI**	Acostic Temperature AlarmAlarm
BVR	Speed Regulator		**K1**	Compressor Contactor
BVRS	Speed Regulator Sensor		**K11**	Defrost Contactor
E	Defrost Heater		**M1**	Compressor Motor Nr.1
E1	Compressor Crankcase Heater		**MP**	Door Microswitch (Room)
EP	Door Heater Circuit		**MVC**	Condenser Fan Motor
ER1	Control Board Heater		**MVE**	Evaporator Fan Motor
ER2	Voltage Regulator Heater		**P1MX**	Cond. Fan Starting Pressure Switch
ES	Condensate Drain Heater		**PMI**	L/P Switch
F13	Voltage Regulator Fuse		**PMX**	H/P Switch
F1	Compressor Fuse		**Q1**	Main Switch
F1E	Electronic Control Cab		**Q3**	Cond. Fan Speed Regulator “Off” Switch
F20	Auxiliary Fuse		**T**	Transformer
FL	Room Light Fuse		**X**	Terminal Board-Connector
FM	Voltage Regulator		**YG**	Refrigerant Solenoid
FTE	Emergency ‘Stat		**YS**	Hot Gas Solenoid

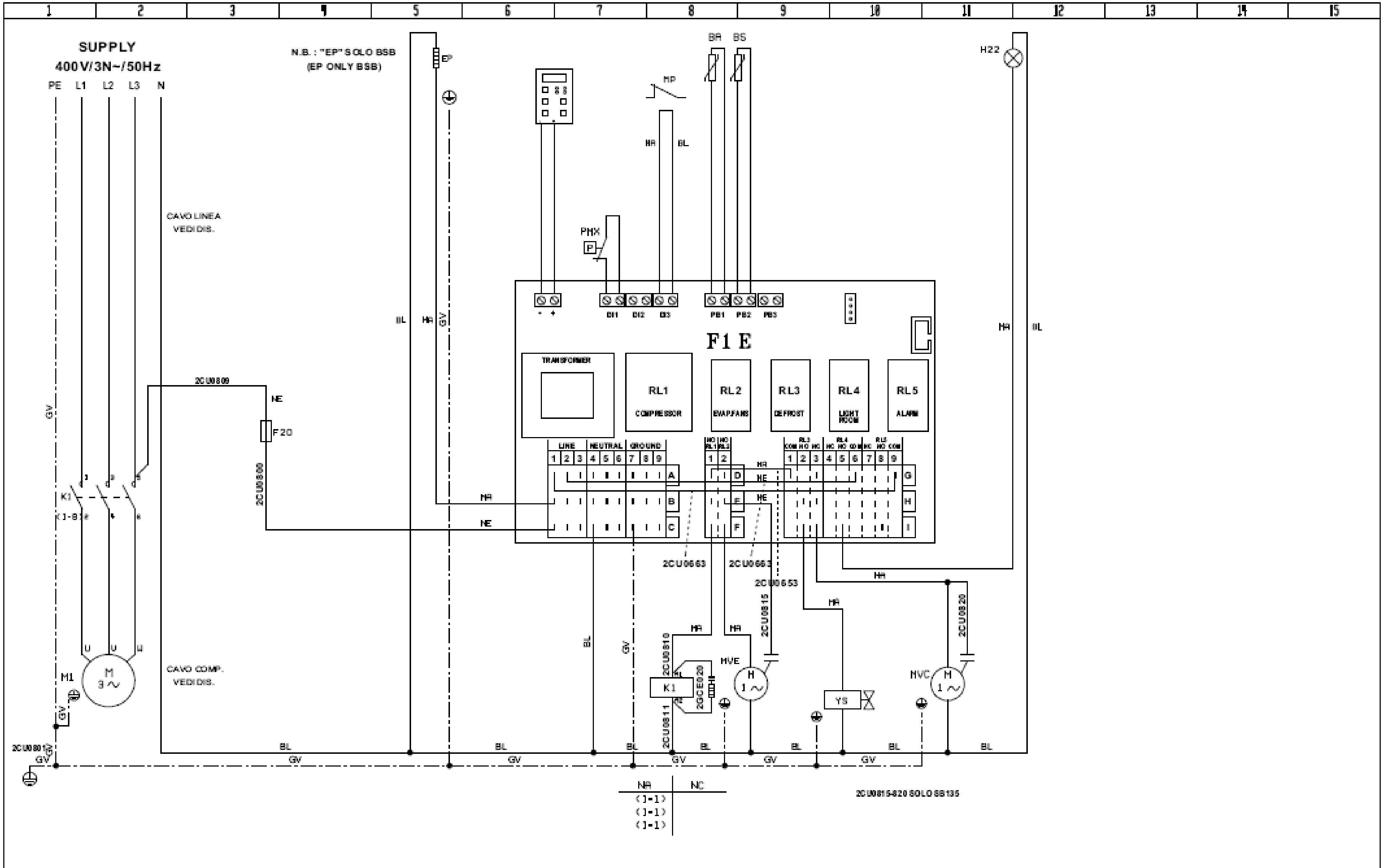
Wiring Diagrams for Ceiling Mounted Solo Units with the Serial Number Ending in 'J'



MODEL

SP1 HC
SP1 HC SPE
SP2 HC
SP2 LC
SP3 HC
SP3 HC SPE

REV.no		DRAWING no 81800LSB		SHEET no: 1 DI 1
DATE	Approved	Drawed Varrella	Approved Sancini	DATE: 11-10-2002



MODEL			
SP3 LC	SP5 HC SPE		
SP4 LC	SP4 LC SPE1		
SP4 HC			
SP5 HC			

REV.no		DRAWING no	SHEET no :
01	Tolto ponte su ID2	81802LSB	1 DI 1
DATE	Approved	Drawed	Approved
21-01-2003	SONCINI	Vanella	Soncini
		DATE:	11-10-2002

Foster European Operations

France
Foster Refrigerator France SA
Tel: (33) 01 34 30 22 22. Fax: (33) 01 30 37 68 74.
Email: commercial@fosterfrance.com

Germany
Foster Refrigerator Gmbh,
Tel: (49) 781 990 7840. Fax (49) 781 990 7844.
Email: info@foster-gmbh.de

Foster Refrigerator
Oldmedow Road
Kings Lynn
Norfolk
PE30 4JU

Tel: 01553 691122
Fax: 01553 691447
Website: www.fosterrefrigerator.co.uk
Email: sales@foster-uk.com

a Division of 'ITW (UK) Ltd'